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AUTHOR Bishart, Gus; Werner, Claire
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ABSTRACT

Competencies for production machine shop are provided for the third of four topic areas: the engine lathe. Each competency appears in a one-page format. It is presented as a goal statement followed by one or more "indicator" statements, which are performance objectives describing an ability that, upon attainment, will establish competency for the stated goal. Indicator statements are further qualified by one or more "benchmark" statements or observable behaviors describing what the trainee will do to prove that he/she is demonstrating achievement of the performance objective. Benchmark statements are followed by an "assessment" statement, which describes how the observer determines that the benchmark is achieved and establishes the criteria for performance. The competencies for this topic are divided into 18 sections: metal cutting, the engine lathe, care of the lathe, speeds and feeds, cutting tools and fluids, drilling a center hole, facing ends, rough turning, finish turning, mounting workpieces, drilling on the lathe, boring, reaming, mandrel, knurling, filing and polishing, turning tapers, and steady and follower rest. (YLB)

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Production Machine Shop Employment Competencies Part Three: The Engine Lathe

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Los Angeles Unified School District
Manpower Program Development

CE 041 204

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PREFACE

The competencies for Production Machine Shop have been developed in four topic areas as follows:

1) Part One: Principles and Practice of Machine Shop

2) Part Two: Saws, Drills, and Grinders

3) Part Three: The Engine Lathe

4) Part Four: The Milling Machine

Each topic has a number of competencies identified. The competencies are presented as a series of goal statements followed by one or more "indicator" statements. An "indicator" is a performance objective describing an ability, which, upon attainment, will establish competency for the stated goal.

Indicator statements are further qualified by a series of "benchmark" statements. A "benchmark" is an observable behavior. Benchmarks describe what the trainee will do to prove that he is demonstrating achievement of the performance objective. Benchmarks are an end result, they do not describe how the trainee learned the behavior, they only state what the behavior is. There may be one or more benchmarks (behaviors) for each indicator statement (performance objective). Benchmark statements are followed by an "assessment" statement. The assessment statement describes how the observer determines that the benchmark is achieved. Assessment statements establish the criteria for performance. Instructor, class member consensus opinion, or combination of instructor input and trainee input may contribute to the final determination of evaluation criteria. The assessments that are shown provide the basis for performance evaluation for each benchmark.

USE OF THE COMPETENCIES

The integration of the material into course curriculums is dependent on the agency providing JTPA training services. Selection of competencies should be based on participant need and compatibility with the course of instruction. The identification of Production Machine Shop Competencies does not attempt to provide input in regards to teaching methodology. The statements present a consensus opinion of optimum skill level for youth entering the work force in the area of Production Machine Shop.

VALIDATION

The competencies were developed from research and direct experience in the instruction of JTPA participants. Validation of the attached material was achieved through a consensus of instructional staff and employer Advisory Boards. Their collective opinion was formed from research and data, which provided the basis for the selection of Production Machine Shop Competencies.

ACKNOWLEDGEMENTS

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Grateful acknowledgement is made of Lucinda Stites, Word Processing Instructor, and her crew of student word processors who have assisted during the production of materials.

The technical information provided in the attached material has been developed form the course text, General Industrial Machine Shop by Harold V. Johnson, Chas. A. Bennett Co., Inc., Peoria, Ill.

Competencies have been written by Gus Bishart with the assistance of Claire Werner as part of the school district's contract with the City of Los Angeles and the State of California.

Bernardo R. Sandoval, Director
Manpower Program Development
December, 1984

SECTION ONE

METAL CUTTING

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the basic principles of metal cutting.

BENCHMARK: The trainee identifies four characteristics that allow for "good machinability."

ASSESSMENT: The trainee provides the following information:

1. Better tool life.
2. Better surface finish.
3. Satisfactory chip formation.
4. Low resistance to cutting force and power.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the basic principles of metal cutting.

BENCHMARK: The trainee identifies and names the most common type of cutting tool.

ASSESSMENT: The trainee identifies and names the lathe.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the basic principles of metal cutting.

BENCHMARK: The trainee identifies the three types of chip formations.

ASSESSMENT: Given a set of pictures showing chip formations, the trainee identifies:

1. Discontinuous segmented chip.
2. Continuous chip without built-up edge.
3. Continuous chip with built-up edge.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the basic principles of metal cutting.

BENCHMARK: The trainee identifies factors which govern chip formation.

ASSESSMENT: The trainee provides the following information:

1. Speed.
2. Feed.
3. Depth of cut.
4. Rake angle.
5. Type of metal being machined.
6. Cutting fluid.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the basic principles of metal cutting.

BENCHMARK: The trainee identifies two factors which determine the quality of surface finish. The trainee states how cutting fluids aid in cutting on a lathe.

ASSESSMENT: The trainee states:

1. The freedom with which the cutting tool moves across the workpiece face.

2. The type of chip produced.

The trainee further states:

1. The proper cutting fluid helps achieve a free-moving tool.

2. The proper cutting fluid permits the chip to move across the face of the tool with minimum interference.

SECTION TWO

THE ENGINE LATHE

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the engine lathe.

BENCHMARK: The trainee names the parts of an engine lathe.

ASSESSMENT: The trainee identifies the following on an engine lathe:

1. Feed Plate
2. Quadrant Gear
3. V-Belt Drive
4. Timing Belt Drive
5. Feed Reverse
6. Feed Compound
7. Speed Change Levers
8. Headstock
9. Carriage
10. Tool Holder
11. Compound Rest
12. Dead Center
13. Tailstock Spindle
14. Lock Lever
15. Handwheel
16. Set Over Screw
17. Leadscrew
18. Feed Rod
19. Control Rod
20. Rack
21. Chasing Dial
22. Chip Pan
23. One-Piece Apron
24. Cross Slide
25. Bed
26. Sliding Gear & Safety Device
27. Drum Switch
28. Feed-Thread Change Handles
29. Cabinet Leg

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the engine lathe.

BENCHMARK: The trainee identifies and names three types of spindle noses.

ASSESSMENT: Given pictures or actual spindle noses, the trainee identifies a (1) threaded type spindle nose, (2) camlock spindle nose, and (3) standard key drive taper nose.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the engine lathe.

BENCHMARK: The trainee identifies and names four types of lathe drives.

ASSESSMENT: Given a set of pictures of lathe drives, the trainee identifies:

1. Flat-belt drive.
2. V-belt drive.
3. Variable speed drive.
4. Geared-head drive.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the engine lathe.

BENCHMARK: The trainee describes the function of various parts of the lathe.

ASSESSMENT: The trainee correctly describes the basic function of (1) the lathe bed, (2) the tailstock, (3) the carriage, and (4) feed and thread-cutting mechanisms.

SECTION THREE

CARE OF THE LATHE

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates his ability to properly care for the lathe.

BENCHMARK: The trainee correctly cleans a lathe.

ASSESSMENT: The trainee follows the appropriate procedure when cleaning a lathe including the following:

1. Uses a brush with stiff bristles to clean chips from the lathe.
2. Uses a clean cloth to remove the last traces of grit and dirt.
3. Stops the lathe when wiping the lathe with a cloth.
4. The threads and sholder on the lathe spindle are cleaned and oiled before mounting a chuck or a faceplate on the spindle nose.
5. The threads in the back of the faceplate or chuck are cleaned with a heavy steel wire bent to shape.
6. The threads of the lead screw are held by a cord of suitable size in the thread groove and cleaned. The ends are pulled back and forth as the lead screw revolves.
7. Tapered holes are cleaned with a bottle brush or cloth wrapped around a stick.
8. Dirt and chips in the dovetail bearing surfaces are cleaned before starting a job on the lathe.
9. When mounting or removing late chucks, the trainee uses a board to support the chuck.
10. If a tool post grinder is used on the lathe, the trainee protects the bedways and other bearing surfaces with a piece of canvas or other suitable cloth.

SECTION FOUR

SPEEDS AND FEEDS

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to properly set the lathe for the correct speeds and feeds.

BENCHMARK: The trainee provides the meaning for equation elements.

ASSESSMENT: The trainee provides the following information:

1. CS - Cutting Speed
2. D - Diameter
3. RPM - Revolutions Per Minute
4. SFPM - Surface Feet Per Minute

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to properly set the lathe for the correct speeds and feeds.

BENCHMARK: The trainee computes cutting speeds.

ASSESSMENT: Given a set of problems to determine the cutting speed for various types of materials, the trainee demonstrates the ability to calculate the correct cutting speed.

SECTION FIVE

CUTTING TOOLS AND CUTTING FLUIDS

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee identifies various cutting tools and cutting fluids.

BENCHMARK: The trainee identifies and names various types of cutting tools.

ASSESSMENT: Given a set of pictures or actual tools, the trainee identifies the following tools:

1. Left- and Right-Cut Roughing Tools
2. Boring and Inside Threading Tools
3. Finishing Tools
4. Facing Tools
5. Round-Nose Turning Tools
6. Threading Tool
7. Parting Tool

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee identifies various cutting tools and cutting fluids.

BENCHMARK: The trainee identifies factors which may result in tool failure.

ASSESSMENT: The trainee states:

1. Temperature failure.
2. Fracture of the tool point.
3. Tool wear.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee identifies various cutting tools and cutting fluids.

BENCHMARK: The trainee identifies the principle purposes for using a cutting fluid.

ASSESSMENT: The trainee provides the following information:

1. To cool the tool and workpiece.
2. To lubricate the tool face, chip, and the built-up edge on the tool.
3. To prevent welding of metal to the tool point and subsequent rough surfaces.
4. To produce a good finish.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee identifies various cutting tools and cutting fluids.

BENCHMARK: The trainee defines the purpose for using toolholders.

ASSESSMENT: The trainee states a toolholder is used to hold the tool in a fixed position in relationship to the workpiece.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee identifies various cutting tools and cutting fluids.

BENCHMARK: The trainee identifies and names toolholders.

ASSESSMENT: Given a set of pictures or actual tools, the trainee identifies and names the following tools:

1. Straight toolholder.
2. Right-hand toolholder.
3. Left-hand toolholder.
4. Right-hand offset parting tool.
5. Boring bar holder.

SECTION SIX

DRILLING A CENTER HOLE

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to use a lathe to drill a center hole.

BENCHMARK: The trainee locates the center of a round object and drills a hole.

ASSESSMENT: Given a project which requires drilling a center hole in a round object, the trainee selects the correct measuring instrument, locates the center, and drills a hole.

SECTION SEVEN

FACING ENDS

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to face ends of work held between centers.

BENCHMARK: The trainee performs a facing operation which results in cutting the end face of a section at right angles to the axis of the workpiece.

ASSESSMENT: The trainee completes the facing assignment by correctly following procedures as follows:

1. Grinds a right-hand facing tool bit with a nose angle of 58°.
2. Installs a half center in the tailstock spindle.
3. Applies lubricant to the center hole and mounts the workpiece between centers.
4. Adjusts the dead center so that the work piece will turn properly.
5. Places a right-cut facing tool in the toolholder for facing the right end of the workpeice. Then places the toolholder in the tool post. Adjusts the cutting edge of the tool so that it is at right angles to the center line.
6. Turns the compound rest at an angle and locks the carriage.
7. Checks to see that the point of the tool is level with the point of the tailstock center.
8. Starts the lathe and advances the tool toward center.
9. With the cross-slide feed crank, draws the tool toward the outside circumference for the finishing cut.
10. Removes the workpiece from the lathe and lays off the length desired.
11. Replaces the lathe dog on the faced end and mounts the workpiece between centers. Face to the scribed line.

SECTION EIGHT

ROUGH TURNING

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to rough turn between centers.

BENCHMARK: The trainee rough turns a workpiece on the lathe to about 0.8 mm (1/32") over the finished size.

ASSESSMENT: The trainee follows the correct procedure to complete rough turning between centers as follows:

1. Cleans the centers. Places in the headstock and tailstock spindles.
2. Checks the alignment of the centers before mounting the workpiece.
3. Installs the drive plate on the headstock spindle and the lathe dog of the proper size on one end of the workpiece.
4. Lubricates the center hole for the tailstock center with white lead or a drop of heavy oil before mounting the workpiece. Places the tail of the dog in the faceplate so that the workpiece rests firmly on the headstock.
5. Inserts the cutting tool in the toolholder and clamps securely.
6. Turns the toolholder so that the cutting edge of the tool is directed slightly toward the tailstock end.
7. Moves the carriage by hand to see that the toolholder clears the dog.
8. Moves the carriage to the tailstock end of the workpiece. Turns in the crossfeed until a chip starts to form.
9. Takes a trial cut about 13 mm long and deep enough to true up the workpiece. Checks the diameter of the workpiece.

CONTINUED ON NEXT PAGE

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to rough turn between centers.

BENCHMARK: The trainee rough turns a workpiece on the lathe to about 0.8 mm (1/32") over the finished size.

ASSESSMENT: CONTINUED

10. Starts the lathe. Throws in the power longitudinal feed, and takes the first roughing cut.

11. After the cutting has reached the halfway point, backs off the tool. Stops the feed, and returns the carriage to the starting point. Reverses the workpiece. Returns the cross-feed to the starting point, and rough-turns the second half to size.

SECTION NINE

FINISH TURNING

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to finish turn between centers.

BENCHMARK: The trainee machines a surface to accurate size, with a fine, smooth finish.

ASSESSMENT:

1. The trainee selects the correct cutting tool, calculates the correct speed, feed, and RPM, and sets the tool in the proper tool holder.

2. The trainee follows the correct procedure when finish turning between centers. Procedure includes:

   a. Inserts the properly ground and honed finish tool bit in the toolholder.

   b. Turns the toolholder until the cutting edge is directed slightly toward the tailstock end so the wool does not dig into the workpiece.

   c. Places the workpiece between centers and lubricates the dead center with white lead.

   d. Using the cross feed, spots the tool on the workpiece.

   e. Takes a trial cut about 16 mm long. Measures the diameter with a micrometer.

   f. Moves the carriage to the right of the workpiece and sets the micrometer collar to zero on the cross-feed screw. Makes a trial cut and measures the workpiece.

   g. Engages the carriage feed. Finish turns the first half of the workpiece.

   h. Places a strip of soft metal around the finished end and replaces the dog.

   i. Turns the other half of the workpiece to size.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to finish turn between centers.

BENCHMARK: The trainee names and identifies the three types of shoulder turns.

ASSESSMENT:

1. The trainee states:

   a. Square shoulder.

   b. Angular shoulder.

   c. Filleted shoulder.

2. Given pictures of shoulder types, the trainee identifies the above stated shoulders.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to finish turn between centers.

BENCHMARK: The trainee turns a shoulder on the lathe.

ASSESSMENT:

1. Given a project which requires finishing a shoulder turn, the trainee successfully completes the assignment demonstrating the correct procedure to produce a shoulder.

2. The trainee selects the correct tool for the shoulder type.

   a. Square Shoulder - Left Hand Facing Tool

   b. Filleted Corner - Round-Nose Turning Tool

   c. Chamfered Shoulder - Right Hand Turning Tool

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to finish turn between centers.

BENCHMARK: The trainee cuts a "groove" using the lathe.

ASSESSMENT: Given a workpiece, the trainee cuts a groove by:

1. Selecting either a square-nose tool bit or parting tool.
2. Setting the tool in the toolholder at right angles to the workpiece.
3. Feeding the tool into the workpiece slowly, with reduced spindle speed.

Instructor's approval indicates satisfactory completion.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to finish turn between centers.

BENCHMARK: The trainee cuts off stock following the correct procedure.

ASSESSMENT: The trainee proceeds as follows:

1. Places the workpiece in a chuck or collet.
2. Mounts a cutting-off tool in the tool post.
3. Sets the tool so that the cutting edge is on center and at a right angle to the workpiece. Locks into position.
4. Checks to make sure the tool is not positioned too high or too low in relation to the center of the workpiece.
5. Adjusts the lathe at the proper speed, about two-thirds the speed used for turning.
6. Marks the location of the cut with chalk or layout dye.
7. Feeds the cutting tool into the workpiece slowly and steadily. Applies cutting oil during this operation.

Instructor's approval indicates satisfactory completion.

SECTION TEN

MOUNTING WORKPIECES

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to mount workpieces on an engine lathe.

BENCHMARK: The trainee names three factors which determine the method of mounting a workpiece in an engine lathe.

ASSESSMENT: The trainee states:

1. The size and shape of the workpiece.
2. The operation to be performed.
3. The area and location of the workpiece surface to be machined.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to mount workpieces on an engine lathe.

BENCHMARK: The trainee names four ways of transmitting the turning power of the spindle to the workpiece.

ASSESSMENT: The trianee states:

1. With the faceplate.
2. With the lathe dog.
3. With the lathe chuck.
4. With the collet chuck.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to mount workpieces on an engine lathe.

BENCHMARK: The trainee identifies and names various types of mounting pieces and gives at least one example of a workpiece that would be mounted in the stated piece.

ASSESSMENT: Given pictures or actual tools, the trainee provides the following information:

1. Faceplate and Lathe Dog - Round workpieces
2. Lathe Chucks - Workpieces that cannot be readily mounted between centers on a lathe can be held in a chuck and machined. Facing, drilling, reaming, and boring operations are examples.
3. Four-Jaw Independent Chuck - Irregular workpieces
4. Three-Jaw Universal Chuck - Round workpieces
5. Headstock Chuck - Workpieces of small diameter, or short pieces that are to be filed or polished.
6. Drill Chuck - Drills, reamers, and taps can be held in this type of chuck.
7. Collet Chuck - Bar stock or workpieces of small diameter and various shapes.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to mount workpieces on an engine lathe.

BENCHMARK: The trainee mounts and removes a chuck from an engine lathe following correct procedure.

ASSESSMENT: When mounting or removing lathe chucks, the trainee proceeds as follows:

1. Removes the faceplate from the lathe.
2. With an ejector bar, removes the live center from the spindle. Does not let the live center drop on the ways of the lathe.
3. Wipes clean the threads on the lathe spindle. Applies a few drops of oil.
4. Clears the threads in back of the chuck using a heavy steel wire. Files the wire ends to fit the shape of the thread in the chuck.
5. Places a wooden cradle on the ways of the lathe.
6. Lifts the chuck and cradle up to the spindle. Turns the chuck clockwise onto the spindle. Rotates the spindle by hand.

To start a chuck so that it can be removed from the spindle, the trainee proceeds as follows:

Engages the back gears and places a wrench on the jaws of the chuck. Gives a quick jerk to loosen the chuck. Places a board or cradle on the ways of the lathe.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to mount workpieces on an engine lathe.

BENCHMARK: The trainee mounts and trues-up work in a four-jaw independent chuck.

ASSESSMENT: The trainee proceeds as follows:

1. Opens the jaw slightly more than the diameter of the workpiece.

2. Rotates the workpiece in the chuck. Moves it up and down. Then tightens the jaws.

3. If the workpiece does not run true, the trainee uses an indicator to find the highest point and adjusts the jaws until a zero reading is achieved.

Instructor's approval indicates satisfactory completion.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to mount workpieces on an engine lathe.

BENCHMARK: The trainee correctly performs at least one facing operation on a workpiece held in a chuck.

ASSESSMENT: The trainee proceeds as follows:

1. For roughing cuts, the trainee uses a left-cut roughing tool. Makes certain that the cutting tool is on center. Sets the lathe at the proper speed. Starts at the outside of the workpiece. Moves the carriage into the workpiece to take the required depth of cut.

2. Feeds the tool toward the center of the workpiece. Uses the power cross-feed to make the cut to the center of the workpiece.

3. For the finishing cut, the trainee inserts a right-cut side-facing tool in the toolholder. Sets the tool so that the cutting edge makes an angle of about 8° to 19° with the face of the workpiece. Sets the point of the tool on the exact center of the workpeice. Moves the tool so that a chip is formed.

4. Locks the carriage in position. Feeds the tool from the center to the outside diameter.

SECTION ELEVEN

DRILLING ON THE LATHE

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to drill in the lathe.

BENCHMARK: The trainee performs at least one drilling operation on the engine lathe.

ASSESSMENT: The trainee proceeds as follows:

1. Centers drill on the workpiece. Runs the tailstock up as close to the workpiece as possible.
2. Replaces the center drill with a twist drill of the desired size.
3. Advances the drill slowly into the revolving workpiece.
4. Lubricates the drill.
5. For a large hole, the trainee drills a small lead hole first.
6. When using large drills, the trainee uses a drill holder.
7. Reverses the toolholder in the tool post to prevent the drill holder from pulling and swinging around. Does not steady the drill and holder in hand.
8. Sets the lathe for the correct cutting speed.
9. Starts the lathe. Feeds the drill by turning the tailstock handwheel, forcing the carriage to move along slowly.

SECTION TWELVE

BORING

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of boring procedures.

BENCHMARK: The trainee defines the term "boring" as it is used in Machine Shop.

ASSESSMENT: The trainee states, "boring" is a process that is used to enlarge or true a drilled or cored hole.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of boring procedures.

BENCHMARK: The trainee identifies two types of boring tools.

ASSESSMENT: Given a set of pictures, the trainee identifies the two main types of boring tools, (1) the solid forged type, and (2) the boring toolholder with cutter attached.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of boring procedures.

BENCHMARK: The trainee performs at least one boring operation on the engine lathe.

ASSESSMENT: The trainee proceeds as follows:

1. Selects the correct boring tool. (One that will clear the hole and is short enough to eliminate any springing activity.)
2. Centers the workpiece in the chuck. Checks to make sure there is enough clearance so that the boring tool will not cut into the chuck.
3. Sets the boring bar in the tool post parallel with the axis of rotation and with the cutting edge as a center.
4. Moves the carriage and cross-feed slide to the correct position, with the cutting edge of the tool in the hole.
5. Adjusts the lathe for the same spindle speed and feeds as for turning.
6. Sets the dial on the cross-feed slide to zero. Turns on the power and engages the carriage feed. Takes a light cut to "straighten" the hole.
7. Disengages the carriage feed and stops the spindle. Backs the tool out of the bored hole without disturbing the cross-feed setting.
8. Checks the hole for size with an inside caliper or a telescoping gage.
9. Starts the spindle. Then, with the handwheel, moves the tool to the workpiece and engages the carriage feed. Takes the cut.
10. Regrinds the tool for the finishing cut. Checks the hole for "bellmouthing".

SECTION THIRTEEN

REAMING

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to ream on the lathe.

BENCHMARK: The trainee describes when a reaming operation would be used.

ASSESSMENT: The trainee states, that holes that have been drilled on the lathe are not always as smooth or accurate as desired. When an accurate hole is required, the hole is first drilled slightly undersized. It is then brought up to size with a reamer.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to ream on the lathe.

BENCHMARK: The trainee identifies the three devices which are used to hold a reamer on the lathe.

ASSESSMENT: Give a set of pictures, or actual tools, the trainee identifies the following:

1. Drill chuck.
2. The floating reamer driver.
3. The crescent wrench.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to ream on the lathe.

BENCHMARK: The trainee performs at least one reaming operation on the lathe.

ASSESSMENT: The trainee proceeds as follows:

1. Drills or bores the hole to the desired size. Allows 0.396 mm (0.016") for reaming.
2. If he/she is using a reamer with a straight shank, it is held in a drill chuck. If the trainee is using a machine reamer with a taper shank, it is placed in the tailstock spindle.
3. Starts the lathe at a low speed. Applies cutting oil to the reamer.
4. Turns the tailstock slowly and feeds the reamer carefully into the workpiece.
5. Keeps the workpiece turning in the same direction until the reamer clears the back of the workpiece.
6. The workpiece is kept rotating until the reamer has been backed out.

Instructor's approval indicates satisfactory completion.

SECTION FOURTEEN

MANDREL

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the function of a mandrel.

BENCHMARK: The trainee describes the use of a mandrel.

ASSESSMENT: The trainee states, a mandrel is a shaft or bar used for holding workpieces that have been previously reamed or bored to the correct size, but need additional machining.

The trainee provides further information as follows:

The workpiece is pressed on the mandrel with an arbor press. It also may be pounded on with a soft hammer. A coat of machine oil must be applied to the mandrel first. Otherwise, the workpiece may be difficult to remove after the operation is completed. Next, a dog is placed on the large and of the mandrel and the unit is set up between the lathe centers. When the mandrel is removed from the workpiece, it is forced out in the direction opposite to that which it entered.

SECTION FIFTEEN

KNURLING

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to knurl on the lathe.

BENCHMARK: The trainee defines the term "knurling" as used in Machine Shop

ASSESSMENT: The trainee states, knurling is the process of embossing the surface of a workpiece with a knurling tool. Knobs and round nuts are knurled to provide a surface that a hand can grasp without slipping. Knurling may also act as an ornament.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to knurl on the lathe.

BENCHMARK: The trainee performs at least one knurling operation on the lathe.

ASSESSMENT: The trainee proceeds as follows:

1. Selects the knurling tool with the degree of coarseness wanted.

2. Lays off the length of knurl wanted.

3. Places the knurling tool in the tool post so that the knurls bear evenly upon the workpiece. Tightens the tool post. The knurling tool is inclined at a very slight angle toward the headstock. The right side of the knurls touch the workpiece first.

4. Place the lathe in back gears and starts the lathe on slow speed.

5. With the hand cross-feed, forces the rollers about 0.40 mm (0.016") into the workpiece. Engages the longitudinal power feed. Allows the knurling tool to travel across the workpiece for about 6.35 mm (0.250"). With a brunch, applies oil to the knurls.

6. Stops the operation to see if a diamond-shaped knurl is being obtained. If not, resets the knurls.

7. Increases the pressure on the wheels and continues knurling.

8. When the left end of the knurling tool reaches the left end of the stock, stops the lathe.

9. Reverses the travel of the carriage. Applies a little more pressure to the knurls with the cross-feed.

CONTINUE ON THE NEXT PAGE

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to knurl on the lathe.

BENCHMARK: The trainee performs at least one knurling operation on the lathe.

ASSESSMENT: CONTINUED

10. Engages the longitudinal feed and allows the tool to feed toward the tailstock end.

11. Repeats the operation until a knurl of the desired depth is obtained.

Instructor's approval indicates satisfactory completion.

SECTION SIXTEEN

FILING AND POLISHING

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to do filing and polishing on the lathe.

BENCHMARK: The trainee provides four reasons when it is appropriate to file on a lathe.

ASSESSMENT: The trainee states:

1. To make a fit on a taper.
2. To remove burrs and sharp corners.
3. To remove tool marks.
4. To prepare the surface for polishing with abrasive paper.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to do filing and polishing on the lathe.

BENCHMARK: The trainee performs at least one filing operation on the lathe.

ASSESSMENT: The trainee proceeds as follows:

1. Selects a single-cut mill file. If a large amount of stock is to be removed, the trainee uses a long-angle lathe file.
2. When filing steel, sets the spindle speed about four times the RPM for rough turning.
3. Loosens the dead center slightly and lubricates the center.
4. Moves the carriage out of the way toward the right and removes the tool post.
5. With uniform strokes, moves the file at a slight angle to the workpiece. Chalks the file to prevent clogging. Keeps the file clean using a file card.
6. The trainee keeps his/her shirt sleeves rolled up out of the way.
7. Files short workpieces left-handed. When doing so, the trainee starts near the tailstock and files toward the headstock.

Instructor's approval indicates satisfactory completion.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates the ability to do filing and polishing on he lathe.

BENCHMARK: The trainee performs at least one polishing operation on the lathe.

ASSESSMENT: The trainee proceeds as follows:

1. Selects the appropriate abrasive cloth for the type of material to be polished.
2. To start the abrasion, uses 80-grit cloth. Uses 120-grit cloth for final polishing.
3. The trainee places the workpiece between centers and lubricates them. He/she does not have the tailstock center too tight against the workpiece.
4. Sets the lathe to run at 5000 feet per minute surface speed.
5. Places the abrasive cloth over a file. or wraps the cloth around the workpiece and holds an end in each hand. Moves the cloth back and forth on the workpiece. Places a little oil on the workpiece or on the abrasive cloth to aid in the polishing operation.

Instructor's approval indicates satisfactory completion.

SECTION SEVENTEEN

TURNING TAPERS

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the principles and procedures related to turning tapers.

BENCHMARK: The trainee defines the term "taper" and names three methods used to taper a workpiece.

ASSESSMENT: The trainee states a tapered workpiece decreases gradually in diameter so that it assumes a conical shape. The "taper" means the graduated diameters between the ends of a tapered section.

The three methods used to taper a workpiece are:

1. Setting the tailstock over the amount required.
2. Using the taper attachment.
3. Setting the compound rest at the proper angle.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the principles and procedures related to turning tapers.

BENCHMARK: The trainee selects the correct formula to calculate offset for turning a taper.

ASSESSMENT: Given problems to determine the offset for tuning a taper on the full length of a workpiece and for a portion of a workpiece, the trainee chooses the correct formula and computes the setover accurately.

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the principles and procedures related to turning tapers.

BENCHMARK: The trainee performs at least one tapering operation on the lathe.

ASSESSMENT: The trainee correctly cuts a taper using one of the following methods:

1. Cutting a taper by the offset method.
2. Turning a taper with the taper attachment.
3. Cutting a taper with the compound rest.

Instructor's approval indicates satisfactory completion.

SECTION EIGHTEEN

STEADY AND FOLLOWER RESTS

COMPETENCY AREA: PRODUCTION MACHINE SHOP

COMPETENCY STATEMENT: The trainee has the ability to machine metal with turning machines.

INDICATOR: The trainee demonstrates an understanding of the steady and follower rest.

BENCHMARK: The trainee identifies and explains when a steady rest is used and when to use a follower rest.

ASSESSMENT: Given a set of pictures or actual tools, the trainee identifies the steady rest and the follower rest.

The trainee provides the following information:

The steady rest is used to support long, slender shafts, with one end held in a lathe chuck or on lathe centers. It is suitable for facing operations or inside threading operations. It is good for other operations on the end of a long piece of work.

The follower rest is attached to the saddle of the lathe to support workpieces of small diameter that are liable to spring away from the cutting tool.